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नियंत्रणों के स्थान और प्रचालन
के लिये दिशानिर्देश
(दूसरा पुनरीक्षण)

**Guidelines for Actuating Forces,
Location and Operation of Operator
Controls on Agricultural Tractors
and Self-propelled Machinery**
(Second Revision)

65.060.10

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Standards after the draft finalized by the 'Agricultural Machinery and Equipment Sectional Committee' had been approved by the 'Food and Agriculture Division Council'.

It was first published in 1976 and revised in 1983. A need was felt to revise this standard to align it with the corresponding ISO standard. The actuating forces required to operate various controls, which were earlier in the standard IS 10703 : 1983 is also included in this revision and this standard after publication will super supersede IS 10703.

In this revision the following modifications have been done:

- a) Technical data has been elaborated in operator of controls on pedestrian operated machines.
- b) Informative addition for further detailed of maximum control actuating forces, direction of motion and control location.
- c) Normative addition of association of operator controls associated with virtual terminals.
- d) Informative identification of hand controls by colour coding.

In the preparation of this standard, considerable assistance has been derived from the following standards:

- | | |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 15077 | Tractors and self-propelled machinery for agriculture — Operator controls — Actuating forces, displacement, location and method of operation. |
| ISO/TS 15079 | Powered lawn, garden and horticultural equipment — Operator controls — Guidance on actuating forces, displacement, location and methods of operation. |

The composition of the Committee, responsible for the formulation of this standard is given at Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GUIDELINES FOR ACTUATING FORCES, LOCATION AND OPERATION OF OPERATOR CONTROLS ON AGRICULTURAL TRACTORS AND SELF-PROPELLED MACHINERY

*(Second Revision)***1 SCOPE**

This standard specifies the preferred method of operation and requirements related to operator controls actuated by hand, feet, or fingers, installed in agricultural tractors and self-propelled agricultural machinery, and used by a seated operator as intended and under the conditions foreseen by the manufacturer. It also gives recommendations for the maximum control actuating forces, direction of motion and location of these controls.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. In case the standards are to be referred in this clause they are to be listed as follows:

<i>IS No.</i>	<i>Title</i>
6283 (Part 1) : 2006/ ISO 3767-1	Tractors and machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays: Part 1 Common symbols (<i>second revision</i>)
6283 (Part 2) : 2007/ ISO 3767-2	Tractors and machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays: Part 2 Symbols for agricultural tractors and machinery (<i>second revision</i>)

*IS No.**Title*

ISO 11783-6 : 2018	Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 6: Virtual terminal
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3 TERMS AND DEFINITIONS

For the purposes of this standard, the following terms and definitions apply.

3.1 Control — Device actuated by an operator to affect a response from the machine, its attachments or its implements.

3.2 Control Actuating Force — Force exerted at the centre of the control contact surface and in the direction of its movement to affect a control function.

3.3 Forward — Direction the operator faces while seated in the operator's seat with the machine and the operator's seat in the position for forward travel as defined by the manufacturer.

3.4 Minimum Control Strength — Ability of a control system to withstand a single excessive application of effort by the operator without being destroyed or having its primary function impeded.

3.5 Accelerator Pedal — Control used on certain machines which, when actuated, increases the engine speed.

3.6 Decelerator Pedal — Control used on certain machines which, when actuated, reduces the engine speed.

3.7 Foot-operated Control — Control manipulated by the operator's foot.

3.8 Hand-operated Control — Control manipulated by the operator's hand.

3.8.1 Hand-operated Control with Finger/Wrist Activation — Hand control manipulated by the movement of one or more fingers or the wrist, with little or no shoulder/elbow motion.

3.8.2 Hand-operated Control with Arm Activation — Hand control gripped by the hand and moved primarily by shoulder/elbow movement.

3.9 Auxiliary Input Unit — Electronic control unit (ECU) containing one or more VT operator controls for common use and facilitating the machine operation.

3.10 Non-critical Function — Machine function which, when actuated, presents a minimal risk to the machine operator or bystanders.

3.11 Critical Function — Machine function which, when actuated, can cause an action that could be hazardous to the machine operator or bystanders.

3.12 Virtual terminal operator control

3.12.1 VT Operator Control — Element of an auxiliary input unit or of a remote key pad, or virtual terminal soft key or touch screen control or reconfigurable proprietary control meeting the requirements of ISO 11783-6 and those specified in Annex B.

3.12.2 Non-critical VT Operator Control VT — Operator control that is suitable only for the control of non-critical functions.

3.12.3 Critical VT Operator Control VT — Operator control input suitable for the control of critical functions.

3.13 Pointing Unit Control — Means of activating and releasing of a function displayed by virtual terminal operator control.

3.14 Hybrid Power Source — Use of two or more distinct types of power, such as an internal combustion engine to drive an electric generator that powers an electric traction drive motor.

3.15 Steering Control Effort — Force applied to the steering control in order to steer the tractor.

4 REQUIREMENTS

4.1 General

4.1.1 Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.

4.1.2 The unintentional actuation of controls shall be avoided, for example, by suitable design or position.

4.1.3 The incorrect actuation of controls shall be avoided, for example, by suitable design, arrangement, marking or lighting.

4.1.4 Controls to be actuated for work or traveling shall be accessible from the seated operator.

4.2 Identification

4.2.1 Control functions and movements shall be identified by symbols conforming to IS 6283 Part 1 and Part 2 so that the operator can determine the proper control function and movement. In cases where these standard does not include a suitable symbol that addresses a machine's function (for example, as a result of new technology), it is acceptable for the manufacturer to develop and use an appropriate symbol. In such cases the meaning of the symbol shall be explained in the operator manual. Identification is not required for controls that have universal recognition by virtue of their shape, colour, location, arrangements or method of actuation, such as a steering wheel, foot-operated clutch pedal, service brake or accelerator pedal.

4.2.2 When a control device is designed and constructed to perform several different actions, the action to be performed shall be clearly identified or displayed and subject to confirmation, when necessary.

4.2.3 For identification of manual controls by colour coding, see Annex C.

4.3 Foot-operated Controls

Foot-operated controls shall be designed to minimize the risk of the foot slipping off the pedal.

4.4 Maximum Control Actuating Force, Direction of Motion, and Location

Guidelines for maximum control actuating forces and generic direction of motion for controls are given in Annex A. Minimum control actuating forces shall be sufficient to avoid inadvertent actuation by the force of a hand or foot resting on the control during anticipated operating conditions.

NOTE — Maximum actuating forces not to be exceeded to meet the braking and steering performance requirements specified by those documents. Actuating forces to be applied for normal operation referred to in this document are usually lower.

4.5 Control Operation

The operation of controls specifically described in Table 1 shall be in accordance with Table 1 if provided on the machine.

NOTE — The control motion indicated in Table 1 represents the motion of several control types such as levers, rocker switches, pairs of push buttons, or sliders. For example, if a pair of buttons or a rocker switch are used to raise and lower the three-point hitch, the interpretation of Table 1, **8.1**, would be to use the button in the upper or rearward position to raise the hitch and the button in the lower or forward position to lower the hitch.

4.6 The location and operation of controls for agricultural tractors and self-propelled machines shall be in accordance with Table 1.

Table 1 Location and Operation of Controls on Agricultural Tractors and Self-Propelled Machines
(Clauses 4.5 and 4.6)

Sl No.	Control	Location	Control Operation and Requirements
1	Engine		
1.1	Starting/stopping engine		Provisions shall be made to prevent the engine starter from engaging unless <ul style="list-style-type: none"> a) the traction transmissions are in neutral or parked position or the traction clutch is disengaged, b) the master implement clutch and, if separate, the PTO clutch are disengaged, c) Hybrid power sources are excluded from the above requirements.
1.1.1	Starting engine (rotational switch)	Should be easily accessible from the operator's position	The control shall be rotated clockwise to operate engine starter.
1.1.2	Engine pre-heater circuit (rotational switch)	Should be easily accessible from the operator's position	If an engine pre-heater circuit is provided, this control shall occur before or at the starting position. It may be activated by rotating the control clockwise, anticlockwise (counter-clockwise) or pushing inwards on the control.
1.1.3	Stopping engine (rotational switch)	Should be easily accessible from the operator's position	The control shall be rotated anticlockwise (counter-clockwise) to the stop position.
1.1.4	Stopping engine (mechanical control)	Should be easily accessible from the operator's position	When the stop control is actuated, controls shall automatically remain in the stop position without the application of sustained manual effort. Direction of motion shall be pull to stop. The control shall be located within 150 mm of the engine start control. If the stop control is combined with the speed control, it shall be in the direction of and beyond the low idle position.
1.1.5	Starting/stopping engine (finger operated push button switch)	Should be easily accessible from the operator's position	The button shall be actuated to start or stop the engine.
1.1.6	Remote engine starting		Provision shall be made to prevent remote engine starting unless: <ul style="list-style-type: none"> a) The traction transmissions are in the neutral or parked position or the traction clutch is disengaged, b) The master implement clutch and, if separate, the PTO clutch are disengaged. c) Hazards associated with engine motion are mitigated.
1.1.7	Ignition switch (if separate from starter switch)	Easily accessible from the operator's seat	Move control to 'on' position
1.2	Engine speed		
1.2.1	Foot-operated	The control shall be readily accessible to the operator's right foot.	The pedal shall be pushed forward, downward, or both forward and downward to increase engine speed.
1.2.2	Hand-operated variable speed	The control shall be positioned in front of, or to the right of the operator.	Direction of motion shall be in a plane generally parallel to the longitudinal axis of the vehicle. The control shall be moved away from the operator (generally forward) to increase engine speed.
1.2.3	Hand-operated discrete settings	The control shall be positioned in front of, or to the right of, the operator.	The actuation of the part of the control which is generally away from the operator shall select higher speed settings.
1.2.4	Decelerator pedal	If provided, the control shall be positioned in front of, or to the right of, the operator and be readily accessible to the operator's right foot.	The direction of motion shall be forward, downward, or both forward and downward to decrease engine speed. A foot-operated engine speed control as described in 1.2.1 shall not be provided.
2	Steering (when travelling in a forward direction)		
2.1	Steering wheel	Should be forward of the operator and aligned approximately with the centreline of the operator seat	When a steering wheel control is provided, a clockwise rotation shall affect a right turn, and an anticlockwise (counter-clockwise) rotation shall affect a left turn.

Table 1 (Continued)

2.2	Two levers	Should be forward or to the sides of the operator. If to the sides of the operator, one lever should be on the left and one lever should be on the right.	When two levers are provided for steering: — A right turn shall be affected by moving the right-hand lever rearward, the left-hand lever forward, or both; — A left turn shall be affected by moving the left-hand lever rearward, the right-hand lever forward, or both.
2.3	One lever	Should be forward or to the side of the operator	When one lever is provided for steering, a lateral motion of the lever to the right shall affect a right turn and a lateral motion to the left shall affect a left turn.
3	Brakes		
3.1	Service brake		
3.1.1	Foot-operated	Pedals shall be readily accessible to the operator's right foot except as noted in 3.1.2.	The direction of motion for engagement shall be forward, downward, or both. Where separate brake pedals are provided for the independent right hand and left-hand brake control, it shall be possible to obtain combined control with one foot.
3.1.2	Foot operated brake used in combination with 4.2.1 and 4.2.2	Should be convenient to the operator	Separate brake pedals for the right-hand and left-hand brake control may be installed to be activated by the left-hand foot in case that a sustained activation of the right-hand pedal(s) is required to keep the vehicle in motion (for example, with hydrostat transmission with one pedal for forward and one for reverse (4.2.2) or a toe and heel pedal for respectively forward and reverse motion (4.2.1).
3.2	Park brake		
3.2.1	Hand-operated with finger/wrist activation (for example, electrical switch or button)	Should be convenient to the operator	The park brake shall remain applied without manual effort. Provision shall be made to prevent unintentional release.
3.2.2	Hand-operated with arm activation	Should be convenient to the operator	The control shall be pulled to apply the brake. A device shall be provided to retain the brake control in the applied position. Provision shall be made to prevent unintentional release.
3.2.3	Foot-operated	Should be convenient to the operator	The direction of motion shall be forward, downward, or both for engagement. A device shall be provided to retain the brake control in the applied position. Provision shall be made to prevent unintentional release.
3.2.4	Combination parking and transmission control	Should be convenient to the operator	Provision shall be made to prevent unintentional disengagement.
3.3	Secondary braking system		
3.3.1	Hand-operated with finger/wrist activation (for example, electrical switch)	Should be convenient to the operator	The control shall be actuated as instructed by the manufacturer. The actuation can include being moved forward or moved away.
3.3.2	Hand-operated with arm activation	Should be convenient to the operator	The control shall be pulled to apply the brake.
3.3.3	Foot-operated	Should be convenient to the operator	The direction of motion shall be forward, downward, or both to apply the brake.
4	Transmission		
4.1	Clutch (includes combined transmission and P T O)		
4.1.1	Foot-operated	The control shall be readily accessible to operator's left foot	The pedal shall be pushed forward, downward, or both for disengagement.
4.1.2	Hand-operated with arm activation	Should be convenient to the operator	The control shall be moved rearward or towards the operator for disengagement. Positive means shall be provided for holding the clutch control in the disengaged position so that it is incapable of being reengaged unless manually operated. It is recommended that the clutch be operable only from the operator's seat.

Table 1 (Continued)

4.2	Combination ground speed and forward/reverse direction (continuously variable combined control)	Should be convenient to the operator	Provision shall be made to prevent unintentional movement of the control from a) neutral to forward or reverse, b) forward to reverse, c) reverse to forward or alternatively. The machine motion due to unintentional movement of this control shall be prevented. The neutral position shall be clearly identified and easy to select.
4.2.1	Foot-operated-one pedal, or two pedals longitudinally related to simulate one pedal	The control shall be readily accessible to the operator's right foot.	Forward motion and increasing forward speed shall be caused by moving the front of the pedal forward, downward, or both. Rearward motion and increasing rearward speed shall be caused by moving the rear of the pedal downward. The requirement of 3.1.1 does not apply in this case.
4.2.2	Foot-operated-two pedals (side by side)	The control shall be readily accessible to the operator's right foot.	Rearward motion and increasing rearward speed shall be caused by moving the outer pedal forward, downward, or both. Forward motion and increasing forward speed shall be caused by moving the inner pedal forward, downward, or both. The requirement of 3.1.1 does not apply in this case.
4.2.3	Hand-operated	Should be convenient to the operator	Forward motion and increasing forward speed shall be caused by moving the control from the neutral position forward, upward, or both. Rearward motion and increasing rearward speed shall be caused by moving the control from the neutral position rearward, downward, or both.
4.3	Speed selection		
4.3.1	Hand operated	Should be convenient to the operator	Speed selection pattern shall be clearly marked.
4.3.2	Foot-operated	Should be convenient to the operator	The control shall be pushed forward or down for higher speed.
4.3.3	Finger operated memory setting (e.g. push button)	Should be convenient to the operator	A push button control shall be pressed to select a set speed.
4.4	Direction control (forward-reverse non-variable speed)	Should be convenient to the operator	Provision shall be made to prevent unintentional movement of the control from a) neutral to forward or reverse, b) forward to reverse, c) reverse to forward or alternatively: The machine motion due to unintentional movement of this control shall be prevented. The neutral position shall be clearly identified and easy to select.
4.4.1	Hand or finger operated	Should be convenient to the operator	The control shall be moved forward, upward, or both to effect forward motion. The control shall be moved rearward, downward, or both to effect rearward motion.
4.4.2	Forward-Reverse momentary switch	Should be convenient to the operator	Finger operated push button - The push button shall be pressed momentarily to change the current direction. Neutral position shall be obtained by other transmission controls.
5	Master implement control, header or gathering unit clutch		
5.1	Hand-operated	Should be convenient to the operator	The control shall be moved rearward or downward for disengagement. Provision shall be made to prevent unintentional engagement of the clutch. The control shall be operable only from the operator's seat.
5.2	Finger-operated	Should be convenient to the operator	Finger operated push button - The push button shall be pressed momentarily to engage and disengage. Provision shall be made to prevent unintentional engagement.
6	Differential lock		
6.1	Foot or hand-operated	Preferably convenient to the operator's right foot or right hand.	The control shall be moved forward or downward for engagement. If the differential lock remains on after release of the actuation mechanism, a means to indicate the differential lock engagement status to the operator shall be provided.

Table 1 (Concluded)

6.2	Finger-operated	Should be convenient to the operator	Finger operated push button-The push button shall be pressed momentarily to engage and disengage differential lock. Provision shall be made to prevent unintentional engagement of the differential lock or to limit the speed when the differential lock can be engaged.
7	PTO (power take-off)		
7.1	Clutch		
7.1.1	Foot-operated	The control shall be readily accessible to the operator's left foot.	The pedal shall be pushed forward, downward, or both for disengagement. In the case of a combined traction-drive/PTO clutch, the PTO disengagement shall be the second stage.
7.1.2	Hand-operated	Should be convenient to the operator	The control shall be moved upward, forward, or both to engage. The control shall be moved downward or rearward to disengage. Provision shall be made to prevent unintentional engagement of the PTO clutch.
7.1.3	Finger-operated	Should be convenient to the operator	Finger operated push button - The push button shall be pressed momentarily to engage and disengage PTO clutch. Provision shall be made to prevent unintentional engagement of the PTO clutch.
8	Implements and auxiliaries		
8.1	Lift mechanism (three-point hitch)		
8.1.1	Hand-operated	The control shall be readily accessible to the operator's right hand	The control shall be moved upward, rearward or both to raise and downward, forward or both to lower. It shall be possible to lock the control levers or mechanism in the upper position.
8.2	Front loader		
8.2.1	Two levers-lift arm, bucket/attachment	The bucket/attachment control shall be located to the right of the lift arm control.	The direction of control motion shall be forward, downward, or away from the operator to lower the lift arm, and in opposite directions to raise the lift arm. The direction of control motion shall be forward, downward, or away from the operator to dump the bucket/attachment, and in opposite directions to roll back the bucket/attachment.
8.2.2	One lever-lift arm, bucket/attachment		The direction of control motion shall be forward, downward, or away from the operator to lower the lift arm, and in opposite directions to raise the lift arm. Movement of the control to the right shall dump the bucket/attachment and movement of the control to the left shall roll back the bucket/attachment.
8.3	Remote hydraulic function		The direction of control motion for a remote hydraulic function shall be forward, downward, or away from the operator to lower or move forward the function; and rearward, upward, or toward the operator to raise or move rearward the function. Additional remote hydraulic functions shall be defined in the corresponding implement's operator's manual.
8.4	Tool attachment controls activated from operator's position		
8.4.1	Lift		
8.4.1.1	Foot-operated non-powered (foot and leg)	Should be convenient to the operator.	The direction of motion should be downward to lift and upward to lower.
8.4.1.2	Foot-operated powered (heel and toe)	Should be convenient to the operator.	The direction of the forward part of control should be downward to lower and upward to raise.
8.4.1.3	Foot-operated powered (two pedals)	Should be convenient to the operator.	Pushing the right pedal should lower the attachment. Pushing the left pedal should raise the attachment.
8.4.1.4	Hand-operated powered or non-powered	Should be convenient to the operator.	The direction of motion should be generally forward or downward to lower, and rearward or upward to raise the attachment.
9	VT Operator controls		
			VT operator controls shall comply with the requirements of Annex B.
*Applies only to raising the complete attachment			

ANNEX A

(Informative)

MAXIMUM CONTROL ACTUATING FORCE,
DIRECTION OF MOTION AND CONTROL LOCATIONA-1 MAXIMUM CONTROL ACTUATING
FORCE

The maximum forces given in Table 2 and 3 should not be exceeded for normal operation. However, emergency situations may require higher forces.

Table 2 Maximum Control Actuating Force
(Clause A-1)

Type of Control	Maximum Force (N)
Lever (fore/aft)	230
Lever (lateral)	100
Lever (vertical upwards)	400
Pedal (leg/foot operation)	450
Pedal (ankle rotation)	90
Finger/wrist operation	20

Table 3 Maximum Permitted Effort

(Clause A-1)

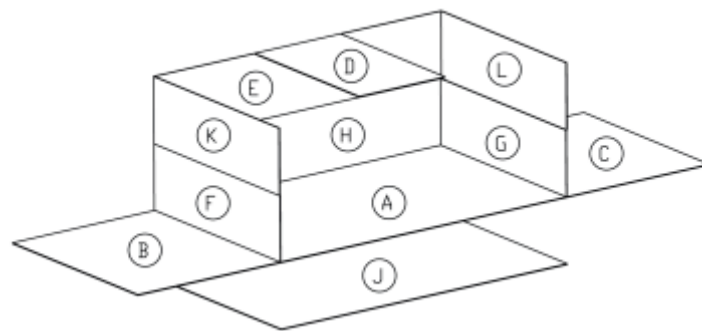
Type of Control	Maximum Force (N)
Steering wheel	250 N for 8 s steering time
Service brake (as per IS 12061)	600 N

Minimum control forces are dependent on the control system, and as such are not stated. Minimum control strength should be sufficient to withstand at least five times its typical actuation force.

A-2 CONTROL ARRANGEMENT

A-2.1 Panels

For the purposes of this document, panels are shown in Fig. 1.



Key

Panel A	horizontal transverse centre
Panel B	horizontal transverse left
Panel C	horizontal transverse right
Panel D	horizontal top centre
Panel E	vertical upper front
Panel F	vertical transverse left
Panel G	vertical transverse right
Panel H	vertical transverse front
Panel J	horizontal lower centre
Panel K	vertical upper left
Panel L	vertical upper right

FIG. 1 PANELS

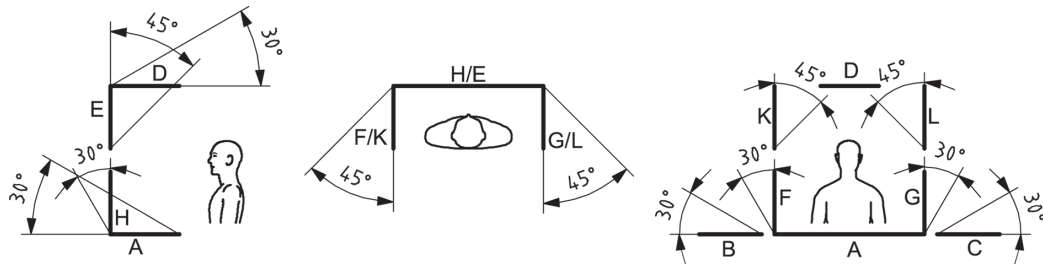


FIG. 2 RECOMMENDED MAXIMUM ANGLES FOR PANELS

A-2.2 Panels Orientation Allowance

A-2.2.1 The recommended maximum angles for panels are given in Fig. 2.

A-2.2.2 Overhead panel D should be horizontal or up to 30° above horizontal.

A-2.2.3 High panel E should be angled 45° or less from vertical.

A-2.2.4 Vertical panels F and G should be angled less than 30°.

A-2.2.5 Horizontal control panels A, B, and C may be tilted up to 30°.

A-2.3 Control Location/Layout

A-2.3.1 If controls are designed with operator rotation in mind, panels B and C should be identical to panel A.

A-2.3.2 If the operator can turn to face side panels F and G, all controls should be similar to H.

A-2.3.3 It is recommended that a control should not be located on a surface which causes ambiguity in the relationship between control movement and function movement.

For example, a lever control for a raise-lower function should not be located on a 30° to 60° upward sloping surface, since the recommended direction of the motion changes when it is moved from a vertical to a horizontal plane.

A-2.3.4 When a sequence of controls is repeated on another panel, the sequence of controls should be the same for each panel.

A-2.3.5 Control design and spacing should allow unobstructed operation without unintentional actuation of other controls. Overlapping of controls is permissible to provide independent or simultaneous control application.

A-3 DIRECTION OF MOTION

A-3.1 Preferred Direction of Movement

A-3.1.1 The preferred direction of movement of controls and the anticipated response for the various control locations are shown in Fig. 3. The alternative responses linked to the control movements are described in Table 4.

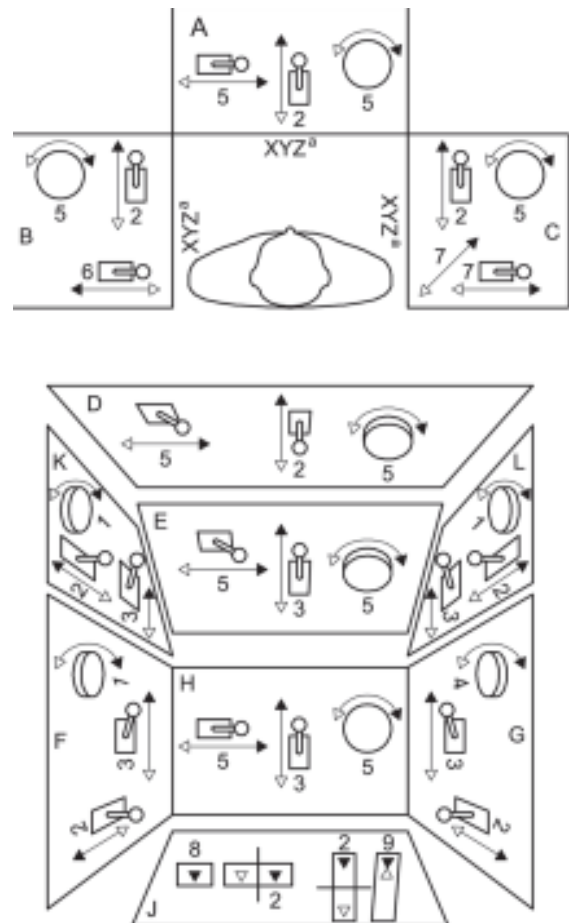


FIG. 3 TYPICAL ALTERNATIVE CONTROL MOVEMENTS

Table 4 Alternative Responses
(Clause A-3.1.1)

1	2	3	4	5	6	7	8	9
Increase	Increase	Increase	Increase	Increase	Increase	Increase	On	Increase
On	On	On	On	On	On	On		
Start	Start	Start	Start	Start	Start	Start		
Forward	Forward	Forward	Backward	Clockwise	Anti-clockwise	Clockwise		
Clockwise	Down	Up	Clockwise	Right	Down	Down		
	Lower	Raise			Lower Left	Lower Right		

Key

- Control movement for the response listed
 → Opposite response for the black-headed arrows

Sequential order for related controls: if a normal or natural order exists for related controls, the order on different panels should be in the sequence shown.

FIG. A-3 TYPICAL ALTERNATIVE CONTROL MOVEMENTS

A-3.2 Controls — General

A-3.2.1 Manual liquid valves rotate clockwise to shut off flow.

A-3.2.2 Push-pull controls should pull for “ON” and push for “OFF”. Rotary controls may have their on-off functions activated by the same push-pull principle.

A-3.2.3 Lever motion indicated in the figure represents the motion of several control types such as levers, rocker switches, sliders and pairs of push buttons.

A-3.3 Controls — Location and Movement Recommendations

A-3.3.1 In panels B and C, right-left actuated control usage can lead to control ambiguity and should be avoided.

If a rotary control on panel G is related to, or operated simultaneously with, a rotary control on panel F, the control motion should be opposite to that shown on G for backward, increase, on, and start.

Levers on panels B and C may be oriented at an angle to provide movement away from, and towards, the operator provided the general principles of operation are met.

ANNEX B

(Normative)

OPERATOR CONTROLS ASSOCIATED WITH VIRTUAL TERMINALS

B-1 GENERAL

Operator controls associated with virtual terminals include, but are not limited to, auxiliary input units as defined in ISO 11783-6, proprietary control units, soft keys and data masks (for example, buttons). These controls also include the interface elements of the virtual terminal that activate the soft keys and data mask objects such as bezel buttons, touch screens or remote keypads. Critical functions shall only be controlled by critical VT operator controls.

B-2 MARKING AND LABELLING OF CONTROLS

B-2.1 Markings

B-2.1.1 Each VT operator control shall be permanently marked. VT operator controls that have more than one actuation position or direction (for example, joysticks, multi-position switches, etc.) shall be marked for each actuation position or direction. Each VT operator control designator displayed on the virtual terminal shall display the corresponding markings.

NOTE — Soft keys physically located relative to the VT operator control designator displayed on the screen such that the relationship is clear need not be provided with additional markings.

B-2.1.2 Auxiliary input units and other input units intended to be installed by the operator shall be marked to show the intended mounting orientation.

B-2.2 Labels

Auxiliary input units shall be designed in such a way as to allow 20 mm square or larger labels to be applied either on or clear relation to the VT operator control. Other data mask objects that can control critical functions (for example, touch screen button objects) shall be provided with labels which are clearly visible. Appropriate labels shall be provided by the function owner (for example, implement). Symbols, when used, shall conform to IS 6283 (Part 1) or IS 6283 (Part 2).

NOTE — The label area for virtual terminal soft keys is provided in the soft key designator specified in ISO 11783-6.

B-3 INSTALLATION

Manufacturers of input units intended to be installed by others (for example, auxiliary input units) shall publish and provide installation instructions to ensure the input unit is mounted in the correct orientation and in such a way as not to interfere with other controls and reduce the likelihood of inadvertent actuation of VT operator controls. Wired input units intended to be used within the operator station shall be equipped with connection cables of appropriate length to allow proper mounting, but not so long as to allow the unit to be operated outside of the operator station.

B-4 PROTECTION AGAINST INADVERTENT ACTUATION

Each critical VT operator control shall be provided with a means of protecting against inadvertent actuation. Such means may include more than one motion to activate the control, shielding around the control, or other methods that fulfil the intent of this requirement.

B-5 ADDITIONAL REQUIREMENTS FOR POINTING UNITS INCLUDING TOUCH SCREEN CONTROLS

Pointing unit controls need requirements for use in addition to the requirements given in this document.

- a) Activation of a function may occur on either depression/touch or upon depression/touch and valid release. Activation upon depression/touch should be avoided except in special circumstances (for example, a control which serves as an

emergency stop, a press-and-hold button used for setting a changeable value).

- b) A valid release shall only be achieved if the release occurs in the object on the screen that was touched (for example, if the operator touches a touch screen button object and slides his finger off the button object, a valid release has not occurred).

B-6 OPERATOR'S MANUAL

Information shall be provided with each unit containing VT operator controls, addressing at a minimum the following items:

- a) mounting instructions, including selection of appropriate locations and preferred mounting orientation;
- b) warnings about the hazards associated with operating the input unit in inappropriate locations;
- c) instructions as required to properly identify the markings on the VT operator controls and to allow the user to properly assign the control to appropriate critical and non-critical functions;
- d) instructions on how to apply appropriate labels to the VT operator controls;
- e) an appropriate warning about the hazards of operating VT operator controls without appropriate labels;
- f) information about the number of each type of VT operator control provided and the types of functions supported by each type of control;
- g) instructions for reading and reviewing the virtual terminal manual to determine its procedure for setting and reviewing VT operator control assignments;
- h) information that this operator's manual only covers the VT operator control unit and that the user should not attempt to use or assign the VT operator controls prior to reading and reviewing the operator's manuals of all other connected components (for example, tractor, implement, virtual terminal);
- j) an appropriate warning that the person who makes the assignments is responsible for ensuring that the correct labels for all VT operator controls are installed prior to operating the VT operator control unit and that these labels shall be replaced as necessary when assignments are changed; and
- k) an appropriate warning that the person who makes or changes the assignments of the VT operator control unit shall inform all operators of the VT operator control unit of the new or changed assignments.

ANNEX C

(Informative)

IDENTIFICATION OF HAND CONTROLS BY COLOR CODING

C-1 GENERAL

C-1.1 For the purpose of this annex, hand controls include, but are not limited to, levers, switches, knobs, handles and buttons that the operator manipulates to activate or control machine functions

C-1.2 When new types of hand control are adopted or combination controls are used, the color shall be selected in accordance with primary function.

C-1.3 If it is not practical to colour code the control, it is sufficient to color code either the area surrounding

the control or the identification of that control rather than the control.

C-1.4 Colour coding does not replace the need for identification by symbols. Controls for function that are not obvious shall be identified in accordance with IS 6283 (Part 1) and IS 6283 (Part 2).

C-2 COLOUR CODING

The colour coding shall be in accordance with Table 5.

Table 5 Colour Coding

(Clause C-2)

Colour		Controls
C.2.1	Red	Single-function engine stop controls. Where key switches, ignition switches or hand throttles are used to stop the engines, the “off” position shall be indicated with red lettering and/or symbols.
C.2.2	Orange	Machine ground motion controls only. EXAMPLE Engine speed controls, transmission control, parking, brake, park-locks, independent emergency brake. Exception: a) Where the engine speed and engine stop controls are combined, the controls may be red; and b) Steering wheels or steering controls may be black or any color other than red and yellow.
C.2.3	Yellow	Function controls which involve the engagement of mechanism only. Example PTO, separators, cutter heads, feed rolls, picking units, elevators, unloading augers.
C.2.4	Black or any other colour except red, orange or yellow	All controls not covered by C-2.1 , C-2.2 or C-2.3 . Example 1 — Component lift or position, such as implement hitch, header height, blade shift and reel lift. Example 2 — Control for uploading components, such as spout cap, uploading auger swing and bin dump. Example 3 — Setting and adjustment mechanisms, such as chokes, cylinder speed, concave lock, lift stops, rockshaft stops, reel speed, and flow dividers. Example 4 — Machine lights, such as headlights, work lights or floodlight, taillight, flashers, and turn signals. Example 5 — Cabin comfort, such as pressurize, cooling, heating and windshield and wipers.

ANNEX D*(Foreword)***COMMITTEE COMPOSITION**

Agricultural Machinery and Equipment Sectional Committee, FAD 11

<i>Organization</i>	<i>Representative(s)</i>
Indian Council of Agricultural Research, New Delhi	DR KANCHAN K. SINGH
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This Indian Standard has been developed from Doc No.: FAD 11 (14133).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi